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TO HOVERFLIES FAUNA (DIPTERA: SYRPHIDAE) OF THE HIGH MOUNTAINS OF EASTERN SAYAN IN SIBERIA

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Summary. A list of 101 species of hoverflies recorded from three high altitudinal belts in the Eastern Sayan mountain region is given. Most species belong to the subfamilies Syrphinae (60 species) and Eristalinae (38 species), while Pipizinae and Microdontinae are presented by two and one species, respectively. Totally, 96 species were found in the forest zone, 37 species were found in the mountain tundra and only *Platycheirus chilosia* has been caught in the golsty belt. New synonymy is established: *Melangyna arctica* (Zetterstedt, 1838) = *Melangyna soszynskii* Mielczarek, 2013 **syn. n.**, = *Melangyna tsherepanovi* (Violovitsh, 1965) **syn. n.**

Key words: Diptera, Syrphidae, fauna, altitudinal distribution, new synonymy, Russia.

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Резюме. В результате проведенных исследований в высокогорьях Восточного Саяна обнаружен 101 вид мух-журчалок. Бóльшая часть собранных видов относится к подсемействам Syrphinae (60 видов) и Eristalinae (38 видов), тогда как подсемейства Pipizinae и Microdontinae представлены, соответственно, двумя и одним видом. Девяносто шесть видов было обнаружено в горно-лесном поясе, 37 видов собраны в высокогорной тундре и только *Platycheirus chilosia* обнаружен в гольцовом поясе. Установлена новая синонимия: *Melangyna arctica* (Zetterstedt, 1838) = *Melangyna soszynskii* Mielczarek, 2013 **syn. n.**, = *Melangyna tsherepanovi* (Violovitsh, 1965) **syn. n.**

INTRODUCTION

Hoverflies (Syrphidae) are a family of universally widespread Brachycera dipterans. The adult flies of this family due to their species richness and expressively pronounced appearance have attracted the researcher's attention for a long time. Nowadays the hoverfly of the Palaearctic region probably have been studied better than in any other part of the world. At the same time both the vast taiga areas in Siberia and the highland area of Central Asia are insufficiently or hardly explored. Until now the Eastern Sayan is noted among the areas with virtually unknown syrphid fauna. A single known publication (Mielczarek, 2013) deals with description

of *Melangyna soszynskii* Mielczarek, 2013 collected in an alpine meadow at an altitude of 1700 meters above sea level in the Valley of Volcanoes. Herein we study the species composition of the hoverflies inhabiting the highland areas of the Eastern Sayan.

MATERIAL AND METHODS

This work is based on materials collected by the research workers (A.V. Barkalov, V.K. Zinchenko) of the Institute of Systematics and Ecology of Animals of the Siberian Branch of the Russian Academy of Sciences (Novosibirsk). They studied the highland area of the Eastern Sayan located on the territory of the Republic of Buryatia (52.12 °N, 100.57 °E) at the July 2020. The collection of insects was carried out using Malaise traps 1.5 and 5.0 m long, 50 yellow pan traps installed at altitudes from 1.950 to 2.200 m above sea level and by entomological net on flowering vegetation in different biotopes. Of the total number about 4 thousand hoverflies caught 3 thousand have been pinned on the very day they've been caught. The yellow pan traps were checked daily and the flies caught have been preserved in 96% ethanol. Flies caught by Malaise traps have been preserved in 76% ethanol. The collected material was determined according to the keys (Violovitsh, 1983; Mutin & Barkalov, 1999; Bartsch, 2009 a,b). The material studied is kept in the Siberian Zoological Museum, Novosibirsk, Russia (ISEA).

RESULTS

Following Samojlova (1967) we use "highlands" in the meaning "landscapes" located above the upper forest border though individual trees can occur there in valleys and hollows that are protected from the winds. It should be noted that highlands in the explored part of the Eastern Sayan are located much lower than those of Altai (Barkalov, 2011). This is due both to northerly position of the mountain range and more continental climate of Central Siberia. The latter causes later summer onset and sharp fluctuation in daily temperatures that affect the seasonal and daily activity of insects. Shrub tundra was presented at an altitude of 2100 m in the area of field work and golsty (rocks devoid of vegetation) were found at an altitude of 2600 m. Insects were collected at a maximum height of 2794 m. Our researches have studied three main types of the landscapes – taiga, tundra and golsty. The taiga zone (belt) that was covered with sparse larch gradually turned into the forest-tundra. The tundra zone (belt) was studied from the border with forest-tundra to its upper limit that borders on bare rocks (golsty). The plants characteristic of taiga and forest-tundra enter the lower part of the tundra zone. These plants usually attract the hoverflies that feed on their flowers. The number of these syrphids is a little bit less than that of taiga. Despite severe climatic conditions in the mountain tundra a wide range of species richness of syrphids is presented here and in the zonal tundra as well (Barkalov, 2011, 2020). It is obvious that some syrphids inhabiting the highlands and absent lower completely carry out their life cycle there. On the other hand, the adult flies due to high mobility are able to migrate up the slope from lower altitude belts in search of flowering plants. However, taking into account of rather rich species diversity of syrphids in zonal tundra (Barkalov, 2015a, b), we can assume that most of species noted in mountain tundra are their permanent inhabitants (Table 1).

Examination of three altitudinal belts allowed us to find out due to what species was formed the highland syrphid fauna of the Eastern Sayan. Totally, 96 species were found in the forest zone, 37 species were found in the mountain tundra and only a single one (*Platycheirus chilosia*) has been caught in the golsty belt (Table 1). Two more species, *Cheilosia milkoi* and *Ch. balu*, collected in the golsty of alpine Altai can be also found in the golsty belt of

Table 1. Tabular check-list of Syrphidae found in the different types of landscapes in the Eastern Sayan Mountain

No	Species	Taiga	Tundra	Goltsy
	Subfamily Syrphinae			
1	*Chrysotoxum arcuatum* (Linnaeus, 1758)	+	-	-
2	*Ch. bajkalicum* Violovitsh, 1973	+	-	-
3	*Ch. fasciolatum* (De Geer, 1776)	+	-	-
4	*Ch. festivum* (Linnaeus, 1758)	+	-	-
5	*Dasysyrphus friuliensis* (van der Goot, 1960)	+	-	-
6	*D. venustus* (Meigen, 1822)	+	-	-
7	*D. pauxilus* (Williston, 1887)	+	-	-
8	*D. shiloi* Barkalov, 2007	+	-	-
9	*Didea alneti* (Fallén, 1817)	+	-	-
10	*Episyrphus balteatus* (De Geer, 1776)	+	-	-
11	*Eriozona syrphoides* (Fallén, 1817)	+	-	-
12	*Eupeodes bucculatus* (Rondani, 1857)	+	+	-
13	*E. corollae* (Fabricius, 1794)	+	-	-
14	*E. punctifer* (Frey in Kanervo, 1934)	+	-	-
15	*Lapposyrphus lapponicus* (Zetterstedt, 1838)	+	+	-
16	*Leucozona glaucia* (Linnaeus, 1758)	+	-	-
17	*L. inopinata* Doczkal, 2000	+	+	-
18	*L. laternaria* (Müller, 1776)	+	+	-
19	*L. lucorum (Linnaeus, 1758)*	+	+	-
20	*Megasyrphus erraticus (Linnaeus, 1758)*	+	-	-
21	*Melangyna arctica* (Zetterstedt, 1838)	+	+	-
22	*M. basarukini* Mutin, 1998	+	-	-
23	*M. coei* Nielsen, 1971	+	-	-
24	*M. compositarum* (Verrall, 1873)	+	+	-
25	*Melanostoma mellinum* (Linnaeus, 1758)	+	+	-
26	*M. scalare* (Fabricius, 1794)	+	-	-
27	*Meligramma guttatum* (Fallén, 1817)	-	+	-
28	*Meliscaeva cinctella* (Zetterstedt, 1843)	+	-	-
29	*Paragus marusiki* Sorokina, 2002	+	-	-
30	*Platycheirus albimanus* (Fabricius, 1781)	+	+	-
31	*P. chilosia* Curran, 1922	-	+	+
32	*P. gunillae* Barkalov et Nielsen, 2008	+	+	-
33	*P. hyperboreus* (Staeger, 1845)	+	-	-
34	*P. jakuticus* Violovitsh, 1978	+	+	-
35	*P. laskai* Nielsen, 1999	+	-	-
36	*P. manicatus* (Meigen, 1822)	+	+	-
37	*P. naso* (Walker, 1849)	+	-	-
38	*P. nigrofemoratus* Kanervo, 1934	+	-	-
39	*P. nielseni* Vockeroth, 1990	+	-	-
40	*P. peltatus* (Meigen, 1822)	+	-	-
41	*P. podagratus* (Zetterstedt, 1838)	+	+	-
42	*P. scambus* (Staeger, 1843)	+	-	-

Table 1. Continue

No	Species	Taiga	Tundra	Goltsy
43	*P scutatus* (Meigen, 1822)	+	-	-
44	*P. setitarsis* Vockeroth, 1990	+	-	-
45	*P. subordinatus* Becker, 1915	+	+	-
46	*Parasyrphus malinellus* (Collin, 1952)	+	-	-
47	*P. nigritarsis* (Zetterstedt, 1843)	+	+	-
48	*P. tarsatus* (Zetterstedt, 1838)	+	+	-
49	*Pyrophaena platygastra Loew, 1871*	+	-	-
50	*Sphaerophoria abbreviata* Zetterstedt, 1859	+	-	-
51	*S. fatarum* Goeldlin, 1869	+	+	-
52	*S. indiana* Bigot, 1884	+	-	-
53	*S. philantha* (Meigen, 1822)	+	+	-
54	*S. tuvinica* Violovitsh, 1966	+	-	-
55	*Syrphus admirandus* Goeldlin, 1996	+	-	-
56	*S. attenuatus* Hine, 1922	+	+	-
57	*S. ribesii* (Linnaeus, 1758)	+	+	-
58	*S. sexmaculatus* (Zetterstedt, 1838)	+	-	-
59	*S. torvus* Osten Sacken, 1875	+	+	-
60	*S. vitripennis* Meigen, 1822	+	-	-
	Subfamily Pipizinae			
61	*Neocnemodon vitripennis* (Meigen, 1822)	+	-	-
62	*Pipiza austriaca* Meigen, 1822	+	-	-
	Subfamily Eristalinae			
63	*Chalcosyrphus tuberculifemur* (Stackelberg, 1963)	+	-	-
64	*Ch. piger* (Fabricius, 1794)	+	-	-
65	*Cheilosia austrosibirica* Barkalov, 2005	+	+	-
66	*Ch. balu* Violovitsh, 1966	-	+	?
67	*Ch. illustrata illustrata (*Harris, 1780)	+	-	-
68	*Ch. lithophila* Barkalov, 1985	+	-	-
69	*Ch. longula* (Zetterstedt, 1838)	+	+	-
70	*Cheilosia melanopa* (Zetterstedt,1843)	+	+	-
71	*Ch. milkoi* Barkalov, 2005	-	+	?
72	*Ch. motodomariensis* Matsumura, 1916	+	-	-
73	*Ch. proxima* (Zetterstedt, 1843)	+	-	-
74	*Ch. sibirica* Becker, 1894	+	+	-
75	*Ch. velutina* Loew, 1840	+	-	-
76	*Ch. vernalis* (Fallén, 1817	+	+	-
77	*Chrysosyrphus nasuta* (Zetterstedt, 1838)	+	+	-
78	*Helophilus affinis* Wahlberg, 1844	+	-	-
79	*H. continuus* Loew, 1854	+	-	-
80	*H. hybridus* Loew, 1846	+	-	-
81	*H. trivittatus* (Fabricius, 1805)	+	+	-
82	*Eristalis hirta* Loew, 1866	+	+	-
83	*E. interrupta* (Poda, 1761)	+	+	-
84	*E. obscura* Loew, 1866	+	+	-

Table 1. Continue

No	Species	Taiga	Tundra	Goltsy
85	*E. rossica* Stackelberg, 1958	+	+	-
86	*E. rupium* Fabricius, 1805	+	+	-
87	*Neoascia tenur* (Harris, 1780)	+	-	-
88	*Orthonevra stackelbergi* Thompson et Torp Pedersen, 1982	+	-	-
89	*Portevinia altaica* (Stackelberg, 1925)	+	-	-
90	*Rhingia borealis* Ringdahl, 1928	+	-	-
91	*Rh. campestris* Meigen, 1822	+	-	-
92	*Sericomyia jakutica* (Stackelberg, 1927)	+	-	-
93	*Sphegina sibirica* Stackelberg, 1953	+	-	-
94	*S. claviventris* Stackelberg, 1956	+	-	-
95	*S. kurenzovi* Mutin, 1984	+	-	-
96	*S. melancholica* Stackelberg, 1956	+	-	-
97	*Volucella bombylans* (Linnaeus, 1758)	+	-	-
98	*V. pellucens* (Linnaeus, 1758)	-	+	-
99	*V. plumatoides* Hervé–Bazin, 1923	+	-	-
100	*Xylota triangularis* Zetterstedt, 1838	+	-	-
	Subfamily Microdontinae			
101	*Microdon analis* (Macquart, 1842)	+	-	-
	Total:	96	37	3

Abbreviations: (+) – species present; (-) – species absent; (?) – species collected in the golsty belt of Altai and also can be found in the same zone (rocks devoid of vegetation) of Eastern Sayan.

Eastern Sayan. Fauna of the Eastern Sayan highlands is represented by two constituent elements: 1) proper alpine and arctic-alpine species, that do not enter forest-tundra zone; 2) the species with great ecological tolerance allowing them to inhabit mountains from the foot to the top. The first species give specificity to alpine fauna. Despite some of these species (*Ch. balu*, *Ch. lithophila*, *Pl. gunillae*, *Pl. chilosia*) are geographically widespread they do not move below the tundra belt both in the Altai and in the Eastern Sayan. It is among these species that the inhabitants of the golsty belt are represented. The males of these species usually sit on rocks or hover over at heights of 20–50 centimeters at the highest peaks. Sometimes these flies can be found near triangulation mark installed on the tops. A series of *Pl. chilosia* males was collected on bare stones without any vegetation just near the triangulation mark that is on the Gargan Mount of the Eastern Sayan at an altitude of 2794 m above sea level. Specimens of this species (common in the tundra of Taimyr and Chukotka) have been collected in similar places in Altai. The accumulation of male syrphids and some other insects has been found at the highest peaks in Altai, the Western Sayan and Suntar-Khayata mountains (Barkalov, 2006). This behavior can be interpreted as adaptation which ensures sex meeting of sparse species. While females feed on flowering plants in mountain tundra or in alpine meadows males wait for them near the peaks. In the afternoon females after feeding move to the peaks where copulation takes place. Like to syrphids various insects (butterflies, hymenopterans, flies from the families Muscidae, Sarcophagidae, Tachinidae and some others) have the same adaptation.

The fauna of the Eastern Sayan compared to that of the mountain tundra of Altai and subarctic tundra of Siberia is rather poor in hoverflies. Much more species have been found

Table 2. Number of hoverfly species in the zonal and mountain tundra faunas of Siberia

Region	Subfamily				Total:
	Syrphinae	Eristalinae	Pipizinae	Microdontinae	
Yamal	75	64	2	-	141
Taimyr	56	40	2	-	98
Chukotka	67	31	2	-	99
Altai	100	45	2	1	148

in the forest-tundra and in tundra in the north of Siberia, for example: 141 species in Yamal Peninsula, 98 – in Taimyr, 99 – in the northeast of Chukotka. Relative richness of different syrphids subfamilies species in the faunas of zonal and mountain tundra is almost the same. Most of the species belongs to the subfamily Syrphinae, the subfamily Eristalinae is more or less inferior to the first one and the subfamily Pipizinae is represented by single species, whereas the species of the subfamily Microdontinae are virtually absent in the tundra (Table 2).

In our opinion, the poorness of the syrphid fauna of the Eastern Sayan can be attributed to its being insufficiently studied. Probably, species that form the spring aspect of the fauna are absent in our material. No doubt, other species with adult stage emerging in the second half of summer will found during further studies, but the most abundant and common hoverflies of the Eastern Sayan mountain tundra have already been established.

TAXONOMY

Melangyna arctica (Zetterstedt, 1838)

Scaeva arctica Zetterstedt, 1838: 604. Type locality: "Nordlandia, ad Gieborstad (Lapponia)", Sweden.

Syrphus tsherepanovi Violovitsh, 1965: 7 (lectotype – ♂, Russia: Tuva, Western Tannu-Ola, 1900 m, Khundurgun Pass, 6.VII 1963, N.A. Violovitsh; here designated; deposited in the Zoological Institute, St. Petersburg), **syn. n.**

Melangyna soszynskii Mielczarek, 2013: 339 (holotype – ♂, "Rosja, NU03, Rep. Buriacji, Sajany [= Russia: Republic of Buriatya, Eastern Sayan Mountains, Volcano Valley, 52°43'12.49"N, 99°1'49.37"E], 28.VI 2012, Łukasz Mielczarek leg."; deposited in the Museum of Natural History, Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Kraków), **syn. n.**

TYPE MATERIAL EXAMINED. Lectotype of *Syrphus tsherepanovi* – ♂, **Russia**: "Тува, юж. склон Хундургуна, 6.VII 1963, Виолович coll." [= Tuva, mountain tundra of the northern slopes of the Western Tannu-Ola Ridge, Khundurgun Pass, 1900 m, 6.VII 1963, coll. N.A. Violovitsh]; deposited in the Zoological Institute, St. Petersburg, Russia; here designated for stability of nomenclature and according to Article 75 of the Code (ICZN, 1999). OTHER MATERIAL EXAMINED. **Norway:** Varaldsoy, 31.V 1969, 1♂, T. Nielsen; Breiseterdalen, 1100 moh, on Lom, 1.VII 1974, 1♂, T. Nielsen; Kautokeino, 3–4.VII.1979, 1♂, I. &T. Nielsen. **Austria:** West-Tirol, Bezirk Paznaun, SE Kappl oberes Grübletal, 2000 m, 21.VII 1986, 1♂, Clussen. **Russia:** Yamalo-Nenetskiy Autonomus Okrug, Longotiegan River, 1–28.VII.2015, 8♂, Barkalov & Zinchenko; Taimyr Peninsula, mouth of Yenisei River, Nosok settlement, 14.VII–15.VIII 1977, 80♂, Barkalov; Taimyr Reserve, Ary-Mas field station, 13–23.VII 2010, 30♂, Barkalov & Zinchenko; Altai Republic, Kosh-Ahachskiy District, upper stream of Acturu River, 2104–2500 м, 3–9.VII 2006, 9♂, Barkalov & Zinchenko; Altai, Plateau Ukok, 2200 м, 14.VII 2006, 1♂, Dudko; Buryat Republic, East Sayan, 3–20.VII 2020,

14♂, Barkalov; Zabaikalsky Krai, Sokhondinskij Reserve, 6–13.VIII 1991, 1♂, Barkalov, Gladkevich & Pekin; Yakutia, 232 km from Khandyga to Magadan 8.VI–7.VII 1985, 168♂, Barkalov; Magadan Region, 20 km E Kulu, 27.VII 1983, 1♂, Makarkin; Chukotka, lower reaches of Anadyr River, 21.VII–4.VIII 2013, 2♂, Barkalov & Mutin; Kamtsatka, Kluchevkoe settlement, 4.VII 1909, 1♂, Derzhavin; Kamtsatka, 10 km E of Esso Village, 1200 m, 5.VII 2008, 2♂, Mutin; Khabarovsky Krai, Bureinskij Reserve, 2008 m, 22.VII.2005, 1♂, Lyubechanskij.

REMARKS. The description of *Melangyna soszynskii* corresponds to the characteristics of *M. arctica*, which was not mentioned in the comparative diagnosis given by Mielczarek (2013). Meanwhile, *M. arctica* is widespread both in the high latitudes of Eurasia and in the mountains of Russian Asia (Bagatshanova, 1990; Barkalov, 2011; Mutin, 2010). Studied specimens from Tuva were collected in close proximity to the type-locality of *M. soszynskii*. The males of *M. arctica* differ from Palaearctic congeners by a combination of the following characteristics: eyes bare; face densely pollinose with wide black middle vitta narrowed to antennae; both dark middle vitta and yellow coloration of upper-lateral surface indistinuishable the due to pollinosity (pinned specimens after alcohol keeping have more visible yellow coloration of the face, but small males have completely dark face); mesonotum as a rule with black pile on sides and pale pile in the middle; scutellum dirty yellow medially and darkened laterally; yellow maculae do not reach lateral margins of abdominal tergites and very small or almost reduced on tergite II; legs mainly black, except basal 1/5-1/3 of fore and middle tibia brownish yellow. All these characters are listed in the description of *M. soszynskii*.

We study type of *Syrphus tsherepanovi* and specimens collected by A. Barkalov on the Yenisei River mouth in 1977 and identified by N.A. Violovich as *Melangyna tsherepanovi* and compare it with numerous specimens of *M. arctica* from other localities. All of them are conspecific.

It should be noted that *M. arctica* is characterized by pronounced individual and noticeable geographic variability. As a rule, the frontal triangle of males is 90° or slightly more. The pile on the mesonotum of males vary from mostly black to mostly pale. Such variability is more common for Yakut populations, but it is also observed among Taimyr ones. The size of yellow maculae on tergite II is variable, sometimes they are almost completely reduced, short-oval or almost triangular, but never more than half the size of spots on tergite III.

Thus, new synonymy is established: *Melangyna arctica* (Zetterstedt, 1838) = *Melangyna soszynskii* Mielczarek, 2013 **syn. n.**; = *Melangyna tsherepanovi* (Violovitsh, 1965) **syn. n.**

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